GeoBoreLog

PC Software for Logging Boreholes

Reference Manual

Prepared by:

Interactive Software Designs, Inc.

for

WFLD- FHWA, Vancouver, WA
Contract: DTFH70 – 02 – RFQ – 0038

November 2005

Table of Contents

Introduction

The GeoBoreLog software was developed to assist field engineers and geologists collect borehole data, and other field observations, using a notebook computer. As the information is stored in an electronic format, it may be readily transferred to databases or into software capable of generating borehole logs. The latest version of GeoBoreLog has been specially adapted to transfer information into the popular software, gINT©, which is used by many FHWA offices. With GeoBoreLog, the data is collected once in the field by the engineer, and then upon returning to the office, the data is transferred into a gINT© database. Information from laboratory test may be subsequently added to this database and the retrieval of pertinent information allows the user to quickly generate borehole logs.

By using GeoBoreLog, the user has an opportunity to break the chain which requires the re-entry of manually recorded field data into gINT© to generate the final borehole logs. The direct transfer of field data into the database also reduces the time and effort required to validate the data entry process.

GeoBoreLog Installation

To install the GeoBoreLog software, insert the CD into the cd-drive. The installation should start automatically. If the install does not start automatically, go to "Start, Run" and type "d:\setup" and press enter (where d is the drive letter associated with your CD drive). By default, GeoBoreLog is installed to the directory:

"C:\Program Files\ISDesigns\GeoBoreLog"

unless the user chooses a different location. The installation procedure will place an icon on the desktop, for starting GeoBoreLog, and also sets a folder on the "Start, Programs" menu. This folder, named GeoBoreLog, will include the following items:

1. GeoBoreLog – for starting the GeoBoreLog software
2. GeoBoreLog.pdf – GeoBoreLog Reference Manual (*this document*)

You will need to use Adobe Reader (or Acrobat) to view the Reference File. If Adobe Reader is not installed on your system, run the file "d:\Adobe\install\ AdbeRdr705_enu_full.exe" on the CD to install version 7.05 of Adobe Reader on your system.

GeoBoreLog Components

Setup will install the following 10 files to the GeoBoreLog directory:

1. GeoBoreLog.exe – the executable program file
2. GeoBoreLog.ini – file contains data maintained by the GeoBoreLog software
3. drilltype.txt – text file containing list of drill types
4. sampletype.txt – text file containing list of sample devices
5. igneous.txt – text file contains list of names
6. metamorphic.txt – text file contains list of names
7. pyroclastic.txt – text file contains list of names
8. Sedimentary.txt – text file contains list of names
9. stdole.dll – required system file
10. Microsoft.VisualBasic.Compatibility.dll – a system requirement

Additionally, in a subdirectory ("Support Files") located in the GeoBoreLog folder, the install will place the following seven files:

1. GeoBoreLog.pdf – Reference Manual, accessible from the "Start, Programs" menu,
2. GeoBoreLog.gdt – file containing a gINT© compatible data structure for GeoBoreLog,
3. wfld-fhwa.gdt – file containing a gINT© compatible data structure currently used by WFLD in their Vancouver, WA, office,
4. gINT© compatible library file currently used by WFLD in their Vancouver, WA, office,
5. wfld-fhwa.gci – gINT© compatible correspondence file used to match the data collected by GeoBoreLog to the current data structure used by WFLD in their Vancouver, WA, office,
6. Readme.txt – information about the installation/setup.
7. GeoBoreLog.txt – informational file accessed from "Add or Remove programs" component in MS-Windows©.

These files are also available in the "Documents" and gINT© folders on the CD.

Web Site

The review web site, "www.xstabl.com/GeoLog/ will list:

1. Updated file: "release.txt"
2. Latest version of the program file: "GeoBoreLog.exe" in a zipped file
3. A listing of comments, suggestions, issues, bugs and question submitted to me via email at: ssharma@uidaho.edu or to Gary Evans, gary.evans@fhwa.dot.gov

In case the above site is not available, please check the "Readme.txt " file for information about the web-site, or contact Gary Evans at gary.evans@fhwa.dot.gov.

GeoBoreLog Options

Before starting to use the GeoBoreLog software the user has an option to modify lists associated with "Drill Types", "Sample Types" and names associated with the different "Rock Types". Data for these lists is stored in text files which can be easily edited using the NotePad application. These files may also be edited using a wordprocessor (MS Word, WordPerfect, etc.), but the file must be saved as a true text document.

The original, default files contain the following information:

Drilltype.txt	Aker
	BK Mobil
	Burley
	Christanson
	CME
	Dietrich
	Long Year
	Other

Sampletype.txt	Auger
	43mm O.D. Split Tube Sample
	Core
	51mm in O.D. Split Tube Sample
	76mm Shelby Tube
	82mm in Split Tube Sample (D & M)
	3" Ring Sampler
	Modified California Sampler
	Other

Igneous.txt	Andesite
	Basalt
	Diorite
	Gabbro
	Granite
	Rhyolite

Metamorphic.txt	Gneiss
	Marble
	Quartzite
	Schist
	Slate

Pyroclastic.txt	Breccia
	Cinders
	Lapilli Tuff
	Tuff

Sedimentary.txt	Chert
	Claystone
	Conglomerate
	Dolomite
	Limestone
	Sandstone
	Shale
	Siltstone

Starting GeoBoreLog

GeoBoreLog is started by doble-clicking the icon on the desktop or starting from the "Start\Programs" menu. The opening screen is presented in Figure 1.

From the "File" menu (see Figure 2), you may create new projects and borings, open existing projects and borings, consolidate the borehole files into a single gINT© file and set the default parameters used by the program. These features are discussed below.

Figure 1

Figure 2

New

Create a "new" project in the selected directory, or add a "new" borehole to an existing project.

Open

Open an "existing" project from the selected directory, or open a previously created borehole.

Preferences

Selection of the "Preferences" menu item allows the user to change the default directory, establish defaults units and assign the approach used to define the spatial location of the borehole.

Default Directory – At startup, the program will create a default data directory on the C-drive at: c:\Site_Data to store the project and boring information. Use the "options" feature in the menu to assign a different, default location, for this data (Figure 3).

Units – The program is initially set to use "English" units. If you wish to use *metric* units, you may change this option in "Preferences" using the dialog box shown in the middle of Figure 3..

Borehole Location Unit – This preference may be set in the box shown in the lower part of Figure 3. This allows the user to set the location methods as either:

(1) Station + Offset, or (2) Longitude + Latitude.

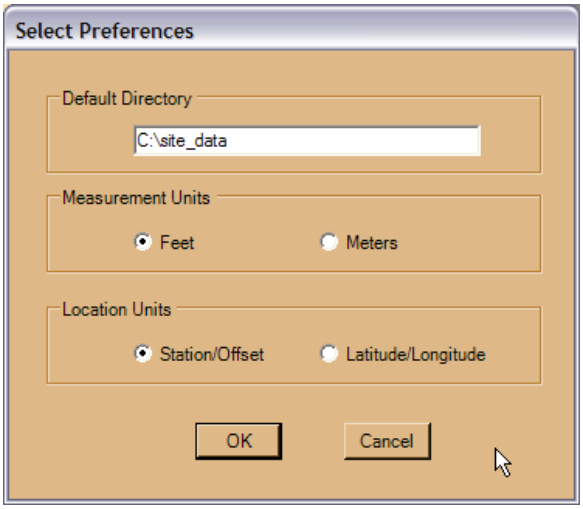


Figure 3

Create gINT file

Merges all the borehole information collected for a project into a single file suitable for importing into gINT. This file will be located in the project directory and is always named "gint.txt".

GeoBoreLog Background

GeoBoreLog Files

After starting GeoBoreLog, the user may (1) start a new project, (2) start a new boring for a current project, (3) open an existing project file, or (4) open an existing borehole file. The main thing to remember is that the folders or directories correspond to **Projects** and the boreholes associated with each project are stored within the project folder. After entering the data for a single borehole in GeoBoreLog, the following files will be written to the project folder:

1. Prjfil.txt – contains information regarding the project
2. *.bhl – the entered borehole information
3. Project.pjt – used to build the "**PROJECT" portion of the gINT file
4. *.pnt – used to build the "**POINT" portion of the gINT file
5. *.smp – used to build the "**SAMPLE" portion of the gINT file
6. *.lth – used to build the "**LITHOLOGY" portion of the gINT file

The files starting with "*" will be created for each borehole. All of the above files are *text* files and may be readily viewed, and printed, using NotePad. *However, the content of the files should not be changed in any circumstances as it may lead to a corrupted series of files.*

Boring Identifier

The filename for each borehole is assembled using the "Boring Identifier" entered into the "Project Information" screen, as shown in Figure 4 below. The identifier can be up to eight alphanumeric characters long.

In this example, the identifier "BHL" will be used to identify the borehole files. With such an identifier, the first borehole file will be named

"BHL-001.BHL"

and the second borehole becomes

"BHL-002.BHL"

and so on. The files used to create the gINT compatible file will also be named according to this convention.

The "Project ID" may be entered here to keep track of the project, but this label is not used directly by GeoBoreLog.

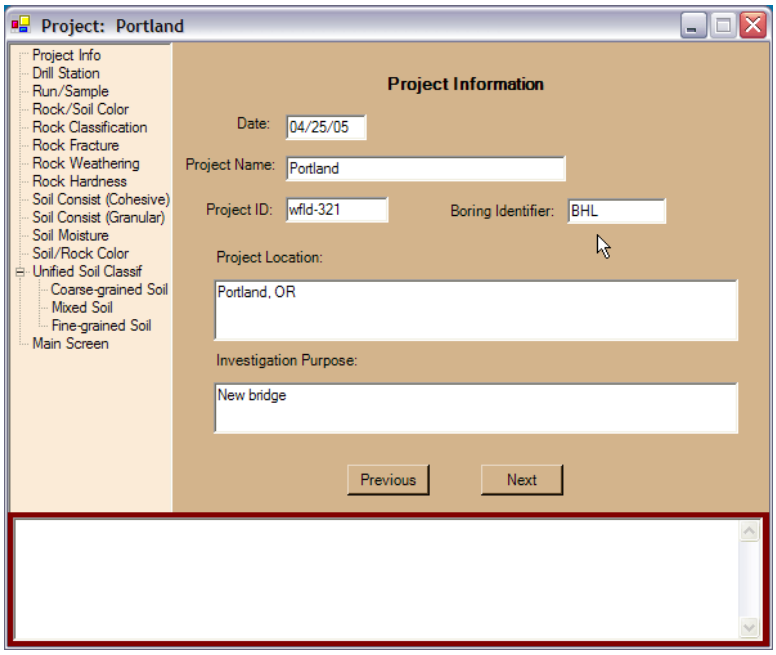


Figure 4

Example GeoBoreLog Session

After data has been entered into the “Project Information” screen, clicking the next button will take you to the “Drill Station” screen where data pertinent to the drill and personnel may be entered. An example of such a screen is shown in Figure 5. Note the filename created using the“Bore Hole Id: 3" in the upper right-hand corner of the figure BHL-003.bhl.

Most of the information in this screen is self-explanatory. The user has an opportunity to add a note regarding any special features of in the “Other” and“Note” fields.

Note that for convenience, the “Boring Started” date is entered automatically when a new borehole is started. The user may change this, if necessary.

Organizations may also pre-prepare a list of typical Drill rigs by modifying the “drilltype.txt” file. The dropdown list corresponding to the data in the provided “drilltype.txt” file is shown in Figure 6.

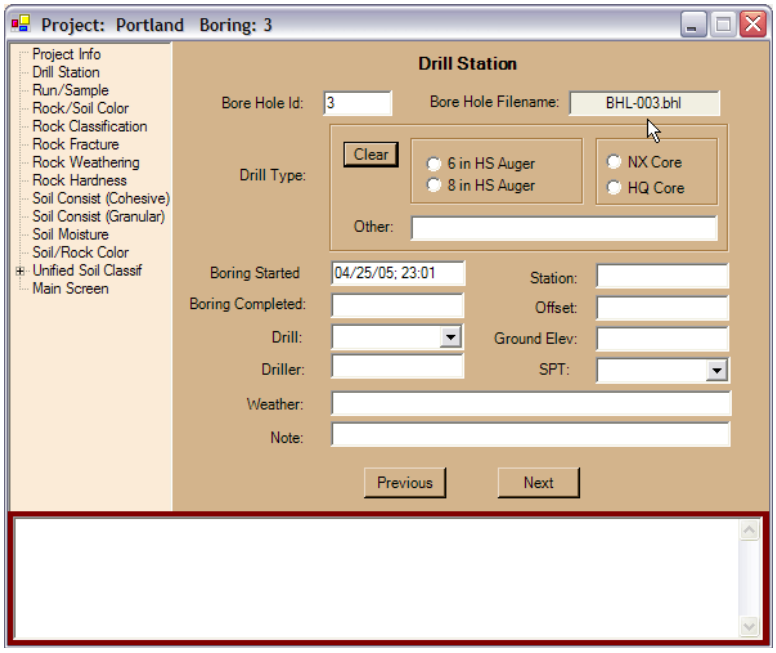


Figure 5

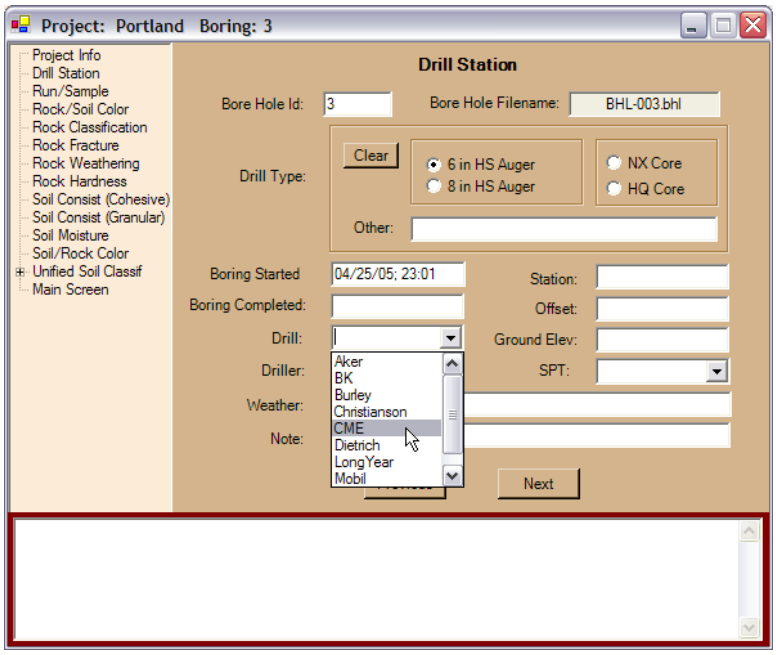


Figure 6

The use of such a list allows the field personnel to quickly select a Drill and also avoid typing mistakes.

A similar, but non-editable, drop-down list is also provided for selecting one of three the “SPT” methods. The possibilities here are: (1) Donut, (2) Safety, or (3) cat-head.

A completed screen for a typical borehole is shown in Figure 7.

In this case the “Station/Offset” method is shown as it is the method preferred by this user. If the preferences had been set for the “Latitude/Longitude” option, the screen would have shown the appropriate label.

This screen also corresponds to the selection of “Feet” as the default units. In this case, for example, the label “6 in HS Auger” is shown. If”metric” units had been selected, the same label would have been displayed as “152 mm HS Auger”.

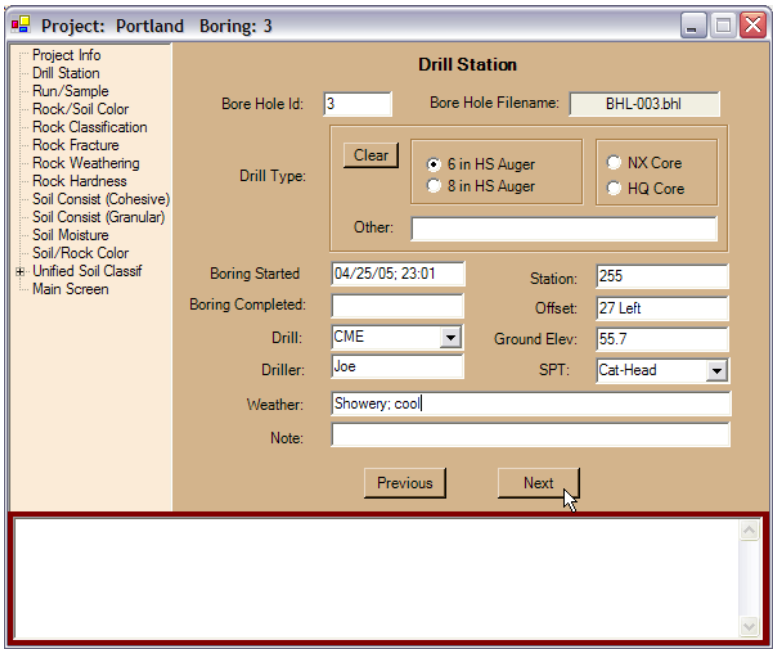


Figure 7

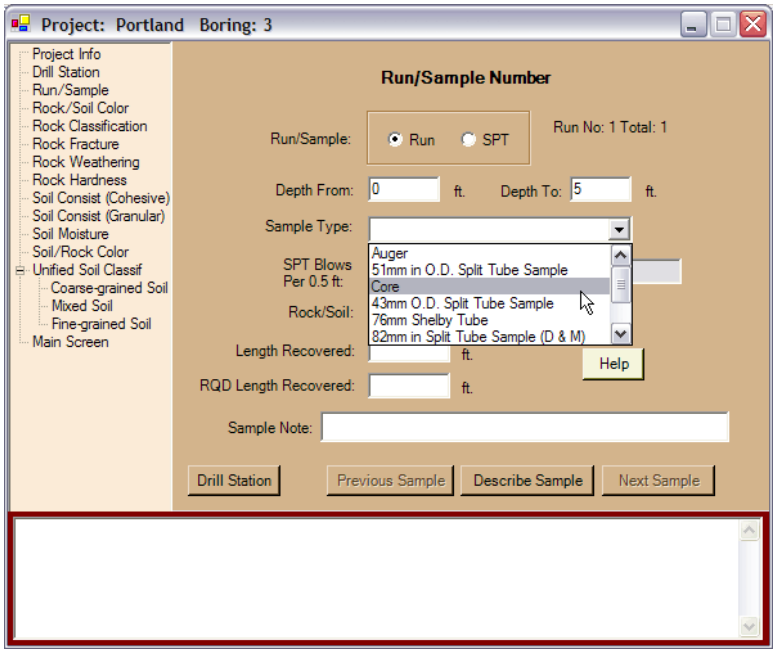


Figure 8

Clicking on the “Next” button takes the user to the “Run/Sample Number” screen shown in Figure 8.

Here, the user must select either “Run” or “SPT”, provide suitable depths, select the “Sample Type” and the preliminary “Rock/Soil” classification.

Again, for convenience drop down boxes are provided to speed up the entry process. This list is read from the editable “sampletype.txt” file located in the “GeoBoreLog” foder (directory).

Unless “SPT” is selected at the top, the SPT blow-count boxes will not be activated.

Further help regarding the various fields is available by pressing the “Help” button.

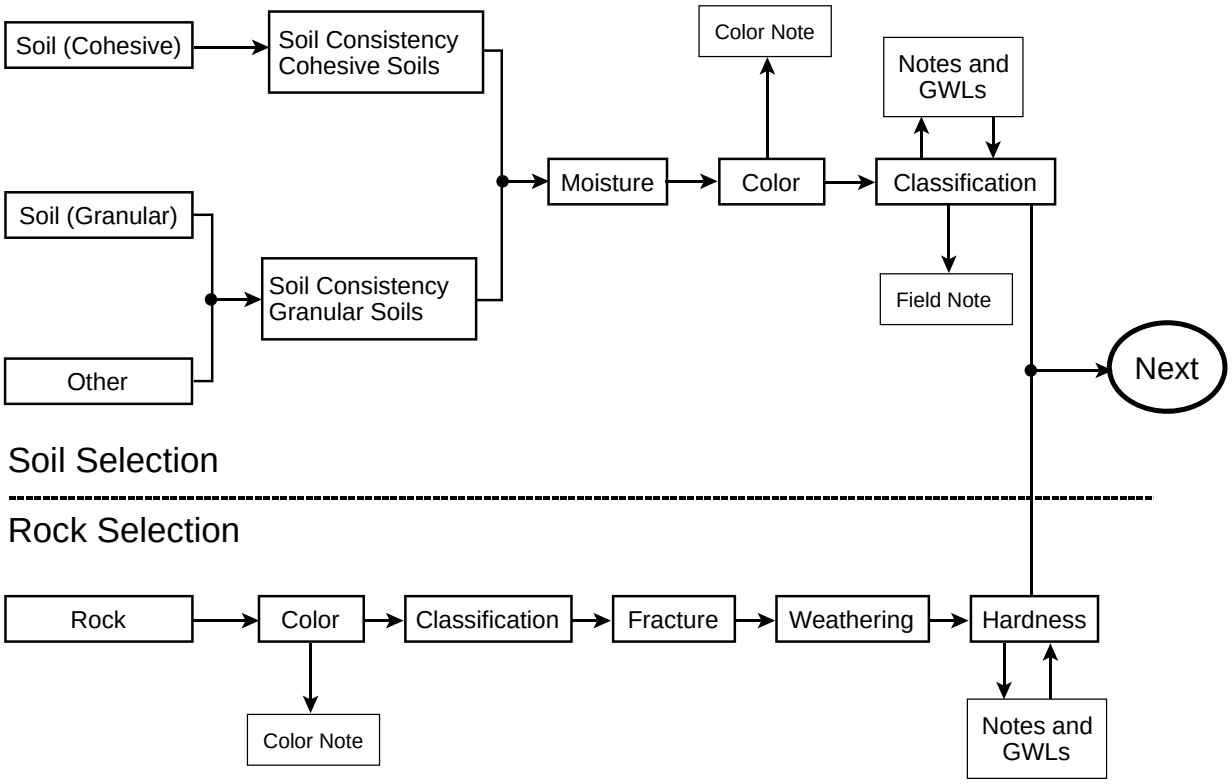


Figure 9

For "Rock/Soil", the user must select one of the four options: (1) Soil (cohesive), (2) Soil (granular), (3) Rock, and (4) Other. In this case "other" refers to materials such as concrete, asphalt, fill, etc. Depending on the selection here, a slightly different sequence of screens will be presented. This is illustrated in Figure 9, above.

In the example session, the first 5 feet were augered and the completed screen is shown in Figure 10. In this case, "Rock/Soil" type has been selected as "Other".

On the basis of Figure 9, the subsequent screens will follow the same path as the "Soil (granular)" selection.

The "Soil Consistency", "Moisture", "Color" and "Classification screens are shown in Figures 11 to 14.

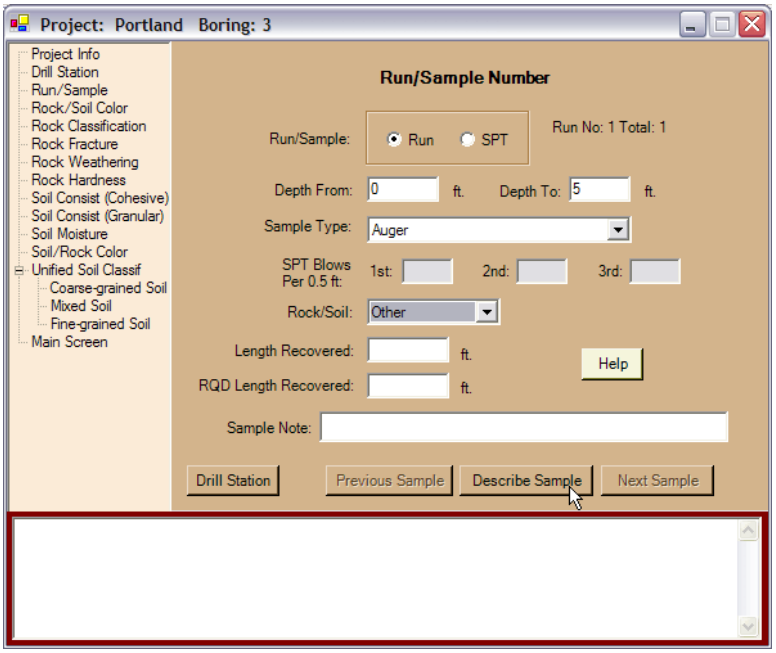


Figure 10

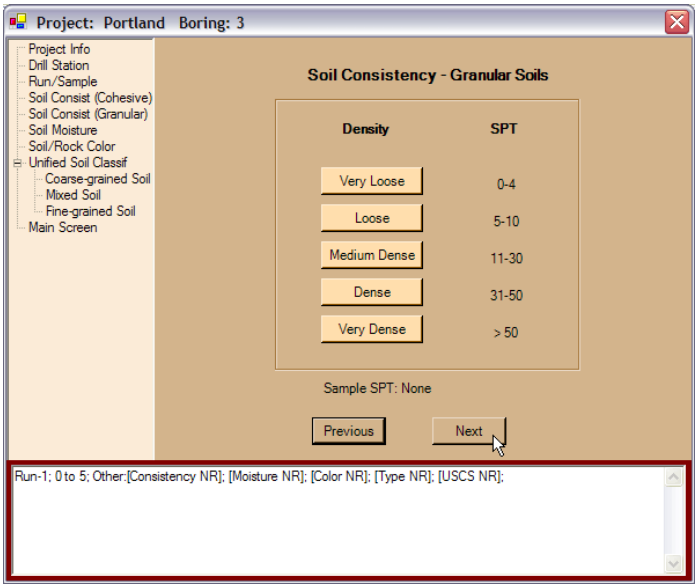


Figure 11

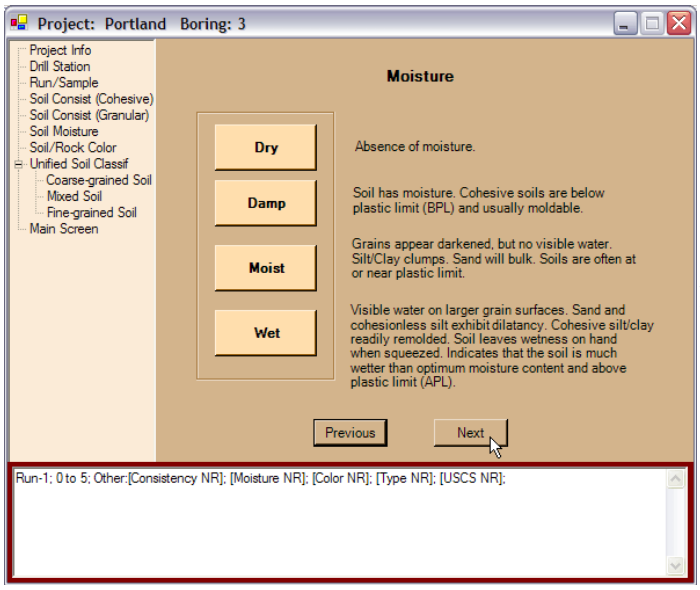


Figure 12

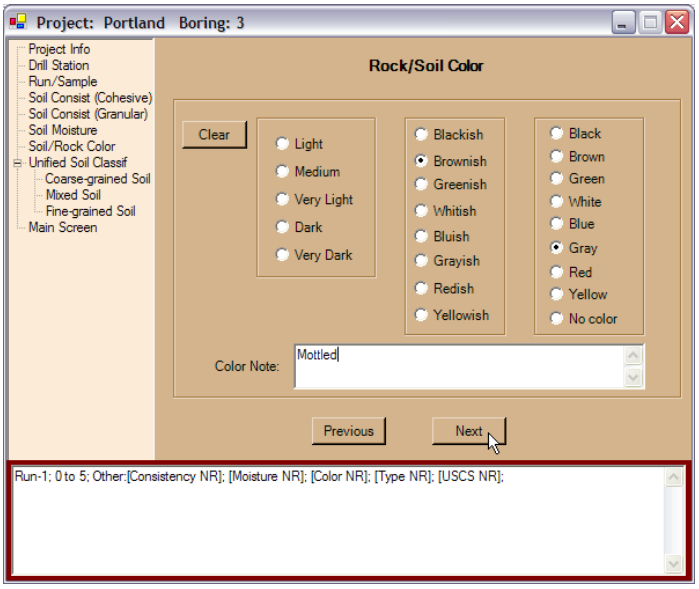


Figure 13

As you progress through each screen, a soil description is assembled and displayed in the window below each form. This description is based on the attributes selected from each screen. The information shown in the screens in Figures 11-12 is entered by clicking on the buttons. In this case, as no selection was made, the soil description shows the default attribute [Consistency NR] and [Moisture NR].

For color, the user selected Brownish Gray in this case. The "clear" button which may be used to clear all entries. Please note a color value is required for all soil descriptions. If none is available, there is an option to specify "No color".

The final screen in the sequence is the "Classification" screen, shown in Figure 14. Here, the user may enter the field classification of the material using the three drop-down lists. In all instances, the user must select a value for the "Type" field. If the soil does not match any of the descriptions, the user may choose the type as "Other". The "Field Note" field provides an opportunity to further describe any unusual features which may assist the design engineers.

In the example shown in Figure 14, the user has determined that the soil is a "Silty Sand".

Depending on the capabilities of the user, the USCS symbol may be selected by clicking on the buttons in the lower half of the screen.

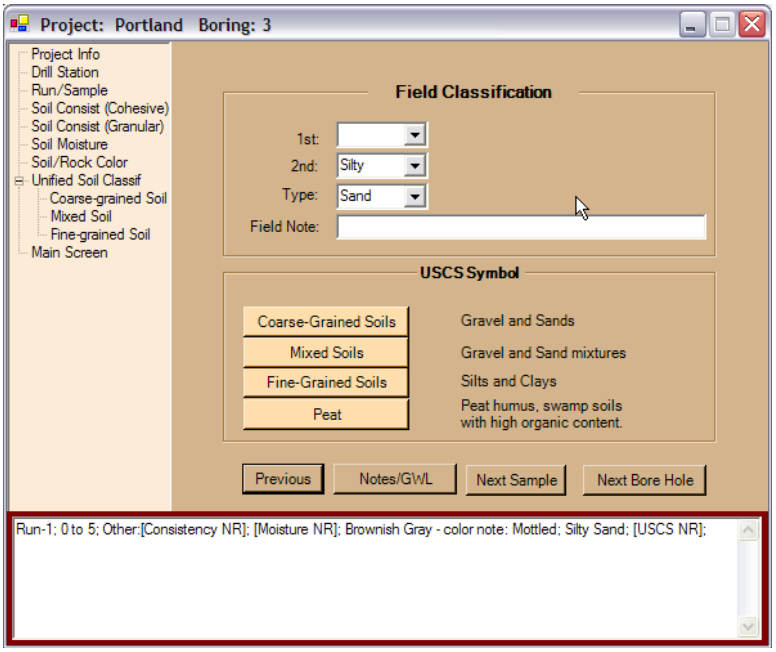


Figure 14

By clicking the "Next Sample" button, the user can repeat the data collection sequence until the hole is completed. In the example case, more information will be added to the borehole file.

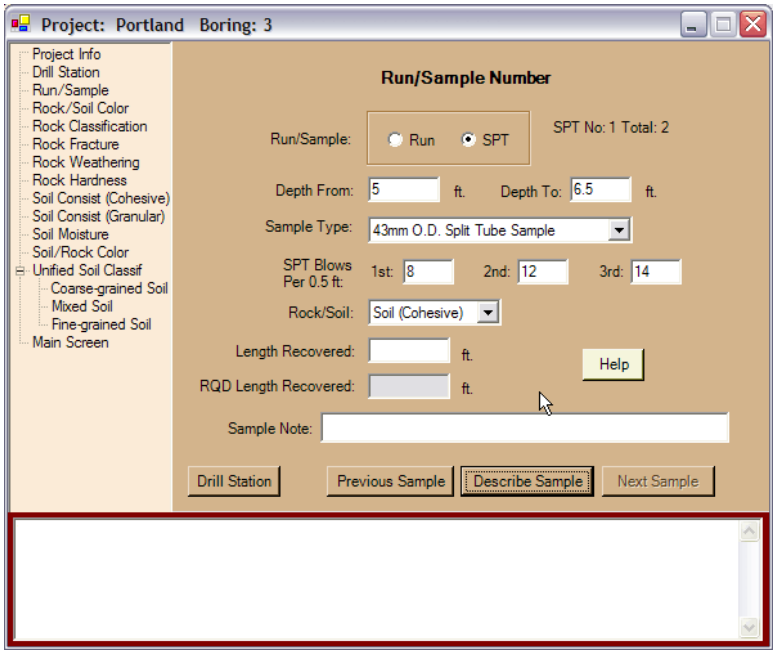


Figure 15

For the second sample interval, the SPT test and the sample type "43mm O.D. Split Tube Sample" is selected. The SPT blow count is recorded for each 6-inch increment and "Soil (Cohesive)" selected for the "Rock/Soil" Field.

Note the label in the upper right-hand corner. This shows that this is SPT No. 1 out of a total sample count of 2. This label is incremented for each "Run" and "SPT'.

The screen shown in Figure 16 is presented after clicking the "Describe Sample" button.

This shows the “Soil Consistency” screen for cohesive soils. To help the user select the appropriate attribute, the SPT value is shown for the sample. Also, if the user hovers over one of the buttons, a short helpful expression describing the consistency level is displayed. In the example show, the SPT value of the sample is “26" and the user may select the “Very Stiff” description if this seems appropriate.

The remaining screens for the second sample interval are not shown as they are similar to the ones described earlier for the 0 - 5.0 interval.

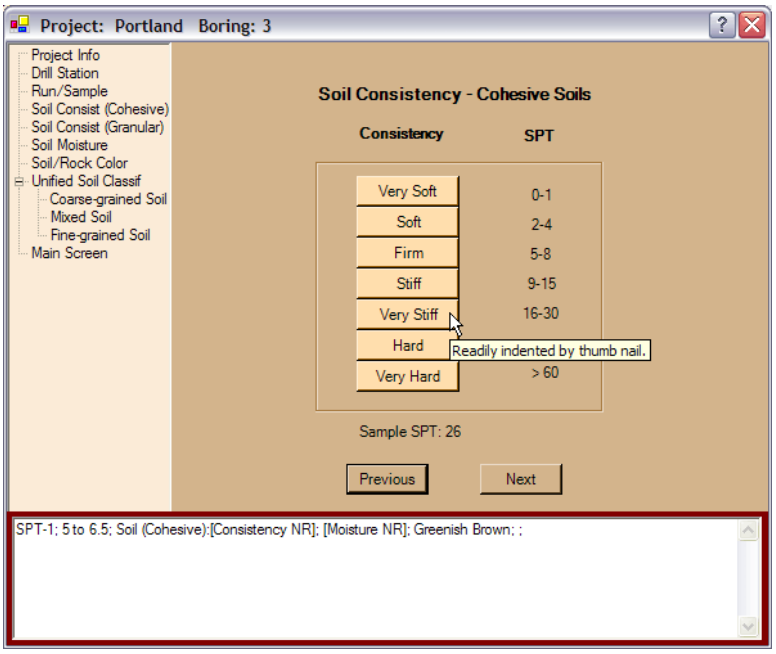


Figure 16

In the example session, it is presumed that the next sampling interval will extend from 6.5 to 11.5 feet and will involve extracting a rock core. The “Run/Sample” screen for this case is shown in Figure 17.

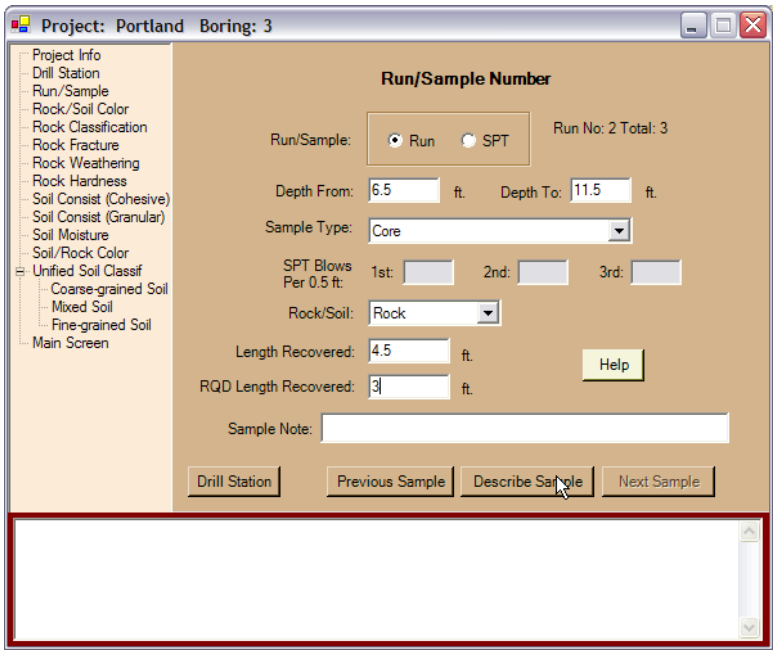


Figure 17

For this run, the “Sample Type” is selected as “Core”. Once the core is recovered, the user should enter values for the “Length Recovered” and the “RQD length Recovered”. These values are used by designers to assign engineering parameters for the rock mass.

The rock description sequence will follow the path indicated in Figure 9. The “Color” screen is presented next, but this will not be discussed here as it is the same as the one shown earlier.

Following the color screen, the unique rock screen shown in Figures 18-21 help the user collect the necessary information.

In classifying rock samples, a general rock type is selected by clicking on one of the buttons. Common names of rocks belonging to this group are then displayed in the small window on the right. In this example, the user selected "Metamorphic" as the group, and then selected "Schist" as the final rock type.

The lists displayed for each rock group are displayed according to the text files bearing the same names. All of these files are located in the GeoBoreLog folder. In Figure 18, the content of file "metamorphic.txt" is displayed in the selection window.

Please note that if you modify these files, you must save them as "text" files. This happens automatically if you use NotePad.

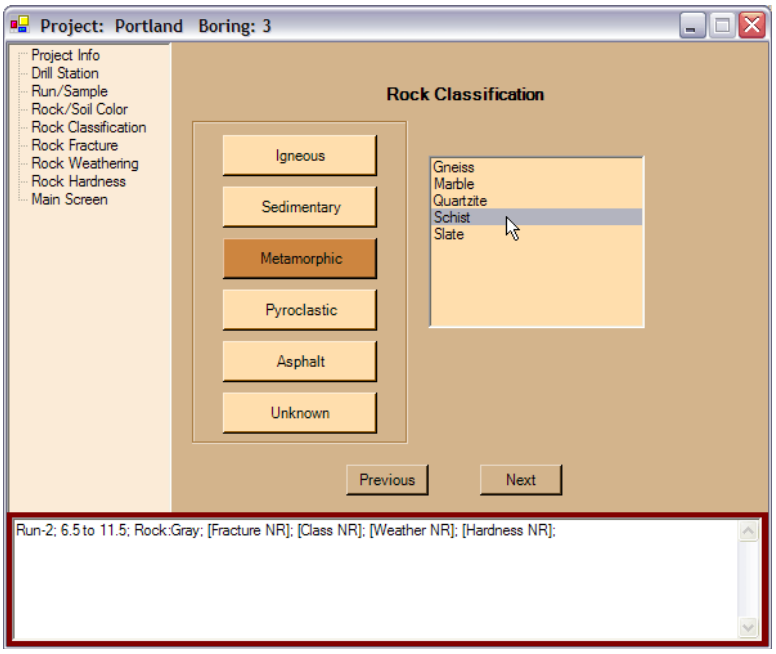


Figure 18

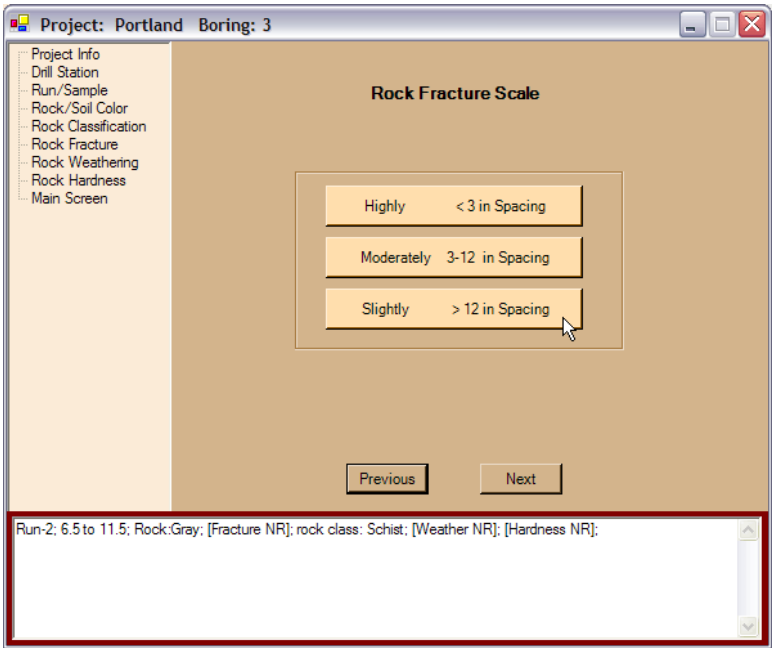


Figure 19

Figure 19 shows the three attributes available for describing the spacing associated with "Rock Fractures".

Screen showing descriptions of various stages of “Rock Weathering”.

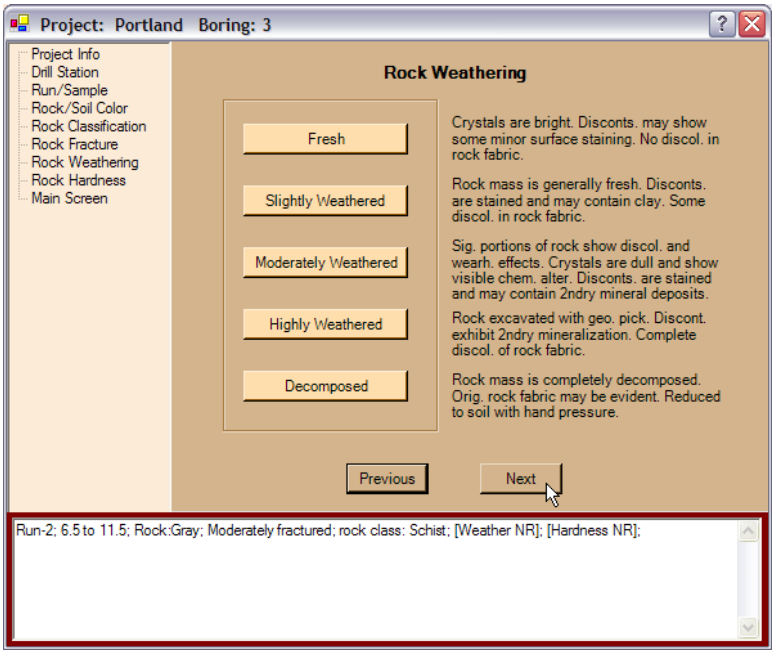


Figure 20

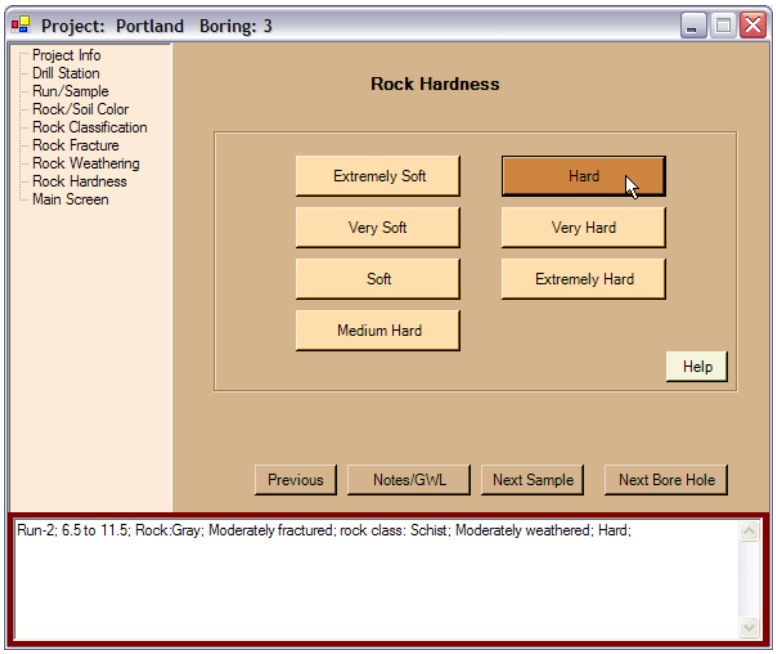


Figure 21

The final screen in the “Rock” sequence is shown in Figure 21. After selecting the appropriate descriptor for “Rock Hardness”, the user may opt to go to the “Next Sample”, “Next Bore Hole”, or enter some notes and GWL conditions.

If the “Notes/GWL” button is clicked, the screen shown in Figure 22 will be displayed.

This dialog box allows the user to add some final notes regarding the sample and other field conditions that may help the designers.

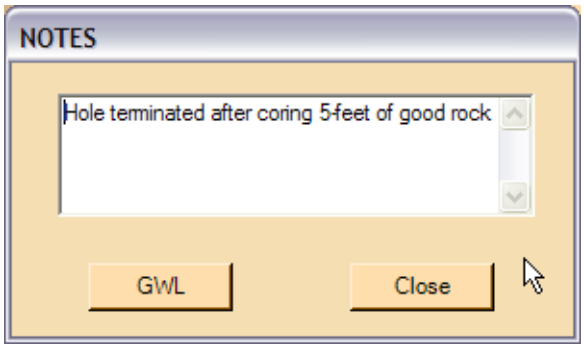


Figure 22

By clicking the “GWL” in the “notes” screen opens up the data entry form for recording the groundwater level (GWL) conditions. GeoBoreLog allows you to record up to six observations. For each observation, the user should enter the depth to the GWL, the date and time.

After entering the notes and GWL data, the user may return to the “Rock Hardness” or “Soil Classification” screen by clicking on the “OK” button. This will return the user to the screen shown in Figure 24.

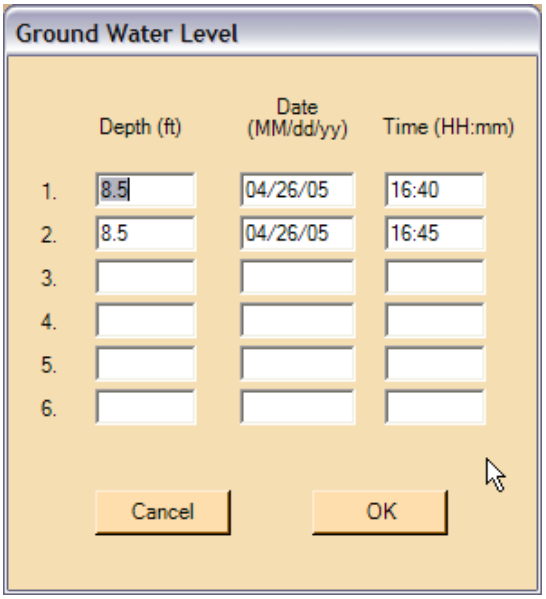


Figure 23

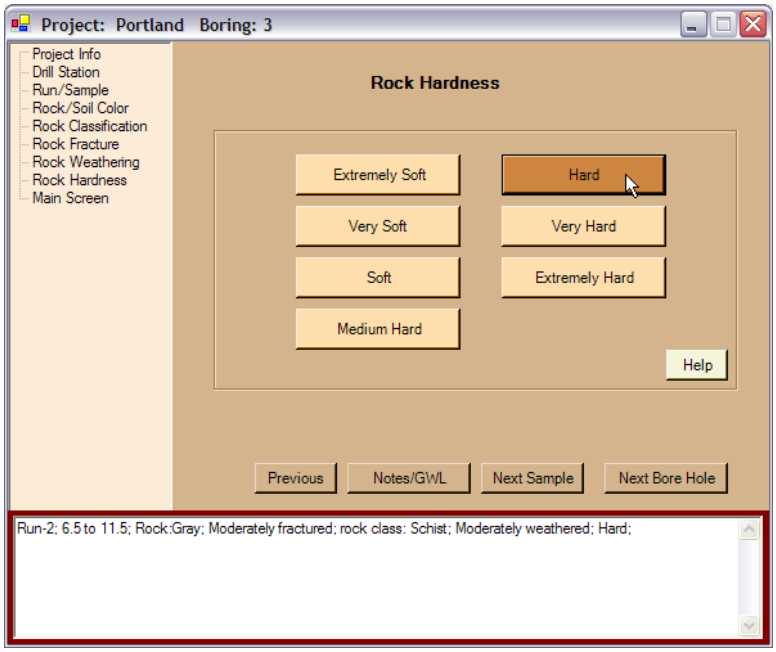


Figure 24

Now we can close the borehole by clicking the “Next Bore Hole” button.

With this click, the user will be presented with the screens shown in Figures 25 and 26. The first screen shows the *current* date and time which will be recorded and the second screen shows the name of the file and the location where it will be saved.

Users should not change the filename assigned by GeoBoreLog as it may lead to corrupted data files.

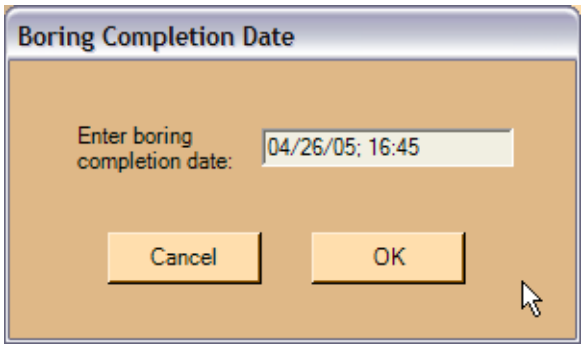


Figure 25

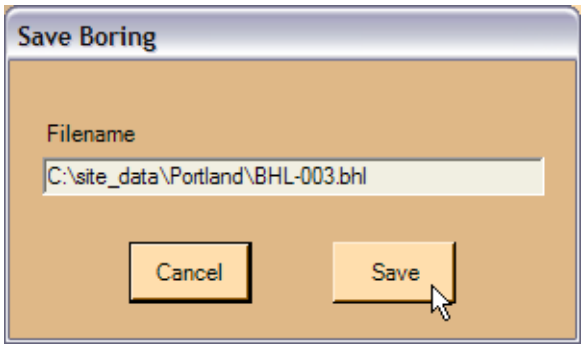


Figure 26

The data collected for the example was written to the file "BHL-003.bhl". The contents of the file are displayed below and an example log generated using gINT© is given at the end of this document.

Contents of file: BHL-003.bhl

```
Project: Portland
Project Id: wfld-321
Boring Ident: BHL
Date: 04/25/05
Location: Portland, OR
Units: feet
Comments: New bridge
Boring No: B-3
Other Equip:
Begin: 04/25/05; 23:01
End: 04/26/05; 16:45
Drill Type: 6 in H-S AUGER
Core Type:
Drill: CME
Driller: Joe
Weather: Showery; cool
Elev: 55.7
SPT Type: Cat-Head
Station: 255
Offset: 27 Left
Drill Note:
GWL: 8.5@04/26/05@16:40;
R-1 depth: 0 to 5
      Length Recovered:
      RQD Length Recovered:
      Sample Type: Auger
      SPT Blows: n/a
      1) 0-5 Other:[Consistency NR]; [Moisture NR]; Brownish Gray -
color note: Mottled; Silty Sand; [USCS NR];
SPT-1 depth: 5 to 6.5
      Length Recovered:
      RQD Length Recovered: n/a
      Sample Type: 43mm O.D. Split Tube Sample
      SPT Blows: 8,12,14,26
      1) 5-6.5 Soil (Cohesive):Very stiff; Damp; Brownish Gray; Silty
Clay; [USCS NR];
R-2 depth: 6.5 to 11.5
      Length Recovered: 4.5
      RQD Length Recovered: 3
      Sample Type: Core
      SPT Blows: n/a
      1) 6.5-11.5 Rock:Gray; Moderately fractured; rock class: Schist;
Moderately weathered; Hard;
      Notes: Hole terminated after coring 5-feet of good rock;
```

Database Structure of gINT Compatible File

The GeoBoreLog software will create a comma delimited file for import into gINT. The databse consists of four tables: (1) PROJECT, (2) POINT, (3) LITHOLOGY, and (4) SAMPLE. A total of 63 fields are defined in these four tables. Table 1, below, provides a list of these 64 fields and their associated data type. The data template file, "GeoBoreLog.gdt", should be used to import this information into gINT.

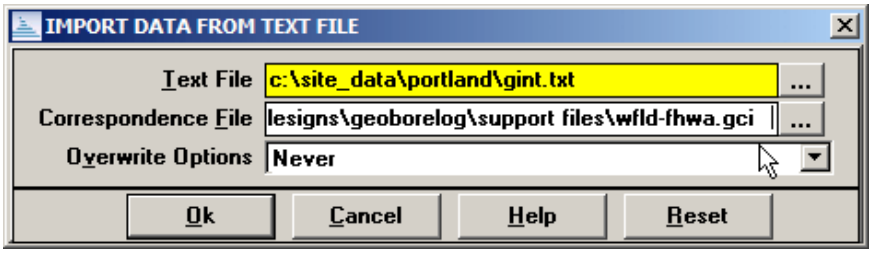
Table Name	No.	Field	Data Type	Comments
****PROJECT**	1	Project Date	text	
	2	Project Name	text	
	3	Project Id	text	
	4	Project Location	text	
	5	Units	text	
	6	Purpose	text	
****POINT**	1	PointId	text	
	2	HoleDepth	text	
	3	Boring Started	text	
	4	Time Started	text	
	5	Boring Completed	text	
	6	Time completed	text	
	7	Drill	text	
	8	SPT Device	text	
	9	Driller	text	
	10	Weather	text	
	11	HSA152	Boolean	
	12	HSA203	Boolean	
	13	NX	Boolean	
	14	HQ	Boolean	
	15	Other	text	
	16	Plunge	double	
	17	North	double	
	18	East	double	
	19	Station	single	
	20	Offset	single	
	21	Elevation	double	
	22	Drill Note	text	
	23	GWL-1	single	depth to the GWL
	24	DATE-1	date/time	
	25	TIME-1	date/time	

Table Name	No.	Field	Data Type	Comments
****POINT**	26	GWL-2	single	
	27	DATE-2	date/time	
	28	TIME2	date/time	
	29	GWL-3	single	
	30	DATE-3	date/time	
	31	TIME-3	date/time	
	32	GWL-4	single	
	33	DATE-4	date/time	
	34	TIME-4	date/time	
	35	GWL-5	single	
	36	DATE-5	date/time	
	37	TIME-5	date/time	
	38	GWL-6	single	
	39	DATE-6	date/time	
	40	TIME-6	date/time	
****LITHOLOGY**	1	PointID	text	
	2	Depth From	single	
	3	Depth To	single	
	4	USCS/CLASSFN	text	
	5	Soil Description	text	
****SAMPLE**	1	PointID	text	
	2	Depth	single	
	3	Length	single	
	4	Sample Type	text	
	5	Number	text	
	6	SPT-1	Integer	
	7	SPT-2	Integer	
	8	SPT-3	Integer	
	9	SPT	Integer	
	10	RQD_Length	Single	
	11	RQD	Integer	
	12	Sampling Note	text	

Importing Data into gINT©

Once the gINT file is created by the GeoBoreLog software, the procedure for importing the data is as follows:

1. Start gINT©, and choose "Input Data".
2. Select File, New Project, Clone Data Template from the menu bar.
3. From the "File Open" dialog box, select the file "wfld-fhwa.gdt", click "Open". *Ideally, you should place this file in the "DATATMPL" directory which is used by gINT© to store templates.*
4. You will now be asked to assign a gINT© project filename and also the location where this "*.GPJ" file should be saved. *Select an appropriate location.*
5. Now you will be presented with the main gINT© screen with the"Project" data table displayed in the upper left of the screen.
6. Select File, Import/Export, Import from Text File from the main menu.
7. A dialog box, Figure 15, will now prompt you for the "gint.txt" file created by the GeoBoreLog software.



The text file containing the gINT compatible data will be the "gINT.txt" file located in the directory, named after the project, where you saved your borehole files. You may browse to the file location. The "Correspondence File" used for this example, "wfld-fhwa.gci", was prepared specially for the WFLD-FHWA. By default, this file is installed in the "c:\ProgramFiles\ISDesigns\GeoBoreLog\Support Files" folder.

8. Click OK and the GeoBoreLog data will be imported by gINT. *Check the subsequent log of import session to make sure that there were no errors. Click OK to close this dialog box.*
9. With a successful import, four data tables: (1) Project, (2) Point, (3) Lithology and (4) Sample will be created. *You may now use this database to assign the other variables to your borehole reports.*
10. The imported data is in a suitable format to generate a borehole log, if required. An example one-page log generated with GeoBoreLog data and gINT© is shown on the next page.
11. For future imports, it is recommended that users merge the information in their current data table file (*.gdt) with structure used in the supplied GeoBoreLog.gdt file. This eliminates the use of a correspondence file, and allows all data (field and lab) to be stored in a single database.

FEDERAL HIGHWAY ADMINISTRATION
VANCOUVER, WASHINGTON
GEOTECHNICAL SECTION

BORING LOG (English Units)

6 in H-S AUGER	☐	BEGAN:	4/25/05
8 in H-S AUGER	☒	COMPLETED:	4/25/05
NQ CORE	☐	DRILL:	Aker
HQ CORE	☐	DRILLER:	John
OTHER:		WEATHER:	Showery, Cold

ELEV: 77.50

DEPTH (ft)	DESCRIPTION	SAMPLE #	BLOWS
0	1) 0-4 Other:[Consistency NR]; [Moisture NR]; Brown; Other; [USCS NR];	R-1	
4.0			
	1) 4-5.5 Soil (Cohesive):Very stiff; Damp; Brownish Black - color note: Mottled; Silty Clay; [USCS NR];	SPT-1	5-9-11
5.5	1) 5.5-8.5 Soil (Cohesive):Firm; Damp; Brownish Green; Sandy Clay; [USCS NR];	R-2	
8.5 ▽	1) 8.5-13.5 Rock:Brownish White; Slightly fractured; rock class: Granite; Fresh; Hard;	R-3	
13.5	Run-4; 13.5 to 18; Rock:Greenish Blue; Slightly fractured; rock class: Rhyolite; Moderately weathered; Medium hard;	R-4	
18.0			

▼ WATER CONTENT (%)
PLASTIC LIMIT ⊢—⊣ LIQUID LIMIT
● SAMPLE PENETRATION RESISTANCE
STANDARD BLOWS PER FOOT
(140 lb mass, 30 in drop)

0 20 40 60

DEPTH (ft): 0, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40

0 50 100

RQD (%)
RECOVERY (%)

43 mm O.D. SPLIT TUBE SAMPLE
51 mm O.D. SPLIT TUBE SAMPLE (SPT)
81 mm O.D. SPLIT TUBE SAMPLE (D & M)
76 mm SHELBY TUBE
AUGER
CORE
▽ WATER LEVEL

PROJECT: Portland
STATION, OFFSET: 200, 23 Left

BORING BHL1
Sheet 1 of 1